IMPLEMENTING AN EFFECTIVE BOILOUT PROGRAM

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PAPER MACHINE AND PULP MILL DEPOSITS CAN BE REDUCED WITH A PLANNED MAINTENANCE PROGRAM THAT INCLUDES A ROUTINE BOILOUT.

DEPOSITION IN PULP MILLS, BLEACH PLANTS, AND PAPER systems can destroy a mill's profitability as off-spec pulp or paper is produced and costly unscheduled shutdowns are taken. A planned chemical cleaning program can reduce these deposit-related problems and assist the mill in achieving its papermaking goals while contributing to the bottom line. These guidelines can be used to establish an effective cleaning program in a mill.

FIVE-STEP APPROACH TO CLEANING APPLICATIONS

Problem identification

Conducting thorough inspections of all accessible system parts is the first step in developing a chemical cleaning program. Surveys of stock flows and inspections should be made regularly so that impending problems become apparent before building to troublesome proportions. After a contamination pattern emerges, a complete system cleanup or boilout should be made before deposits break loose and production is lost.

Points commonly inspected include:

- Washer wires
- Repulper screws and screens
- Stock chests and approach piping
- Headbox and slice area
- Tray, white water, and seal pit
- Saveall screens
- Shower nozzles and vacuum equipment
- In-line instrumentation

Deposit analysis and product selection

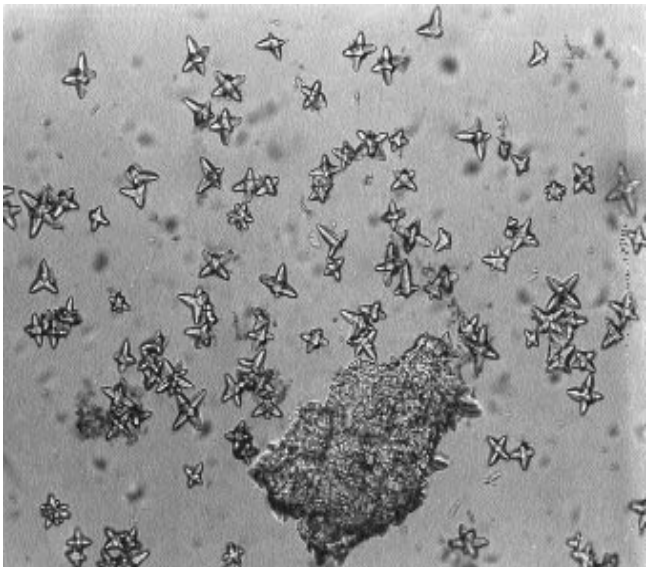
The type of cleaning program you choose depends on the nature of the deposits. Samples of system contaminants should be collected periodically for analysis. **Table I** outlines one method of categorizing pulp and paper mill deposits. There are three primary classifications of contaminants:

- Slime deposits are those in which microorganisms or the byproducts of their metabolism serve as binders. Therefore, the cleaning program for slime deposits should include strong toxicants to sterilize the system, and surface-active agents to penetrate and disperse the slime masses. This combination allows the toxicant to kill the organisms and loosen the slimes so that they may be more easily removed from the system.
- Organic deposits include pitch-type material from natural wood sources and secondary fiber. Process additives such as oil-based defoamers and equipment lubricants can also contribute to the organic extractives. It is sometimes desirable to use organic solvents to emulsify these sticky substances, especially to remove contaminants from machine clothing. However, it is not practical to circulate solvents through an entire stock system during boilouts. This chemistry is more effective in combination with hot, strongly alkaline solutions combined with the proper dispersants or surfactants. The cleaning program will soften, loosen, solubilize, wet-out, and disperse deposits so they may be removed from the system.
- Scale compounds are bound together by inorganic materials, yielding a tenacious deposit that is difficult to remove. Typical scales are comprised of calcium carbonate, calcium oxalate, barium sulfate, and aluminum hydroxide.

Calcium from the wood and carbonate entering from mill water or the bleaching process will combine to form $CaCO_3$ scale. This grayish-white deposit responds to acid cleaning compounds. Choose acid cleaners carefully to minimize acid attack on mill equipment. Inhibited blends of organic acids or phosphoric acid programs are preferred to decrease corrosion. However, stronger mineral acids, including sulfuric or hydrofluoric solutions, may be

Type	Composition	Micro-organism activity	Inorganic materials	Organic materials	Fiber and fines	Occurence
↑	Primarily microbial	High	Low	Low	Low	Infrequent
↑	Mixed microbial-chemical microorganisms act as binders	High	Low	Low to moderate	Moderate	Occasional
Slime ↓↑	Mixed microbial-chemical where both microorganisms and chemicals act as binders	Moderate	Moderate to high	Moderate to high	Moderate to high	Frequent
Pitch ↓↑	Mixed microbial-chemical where organic materials act as binders	Low	Low to moderate	High	Moderate to high	Frequent
↕	Primarily organic	Low	Low	High	Low to moderate	Occasional
Scale ↓	Mixed microbial-chemical where inorganic materials act as binders	Low	High	Low to moderate	Moderate to high	Frequent
↓	Primarily inorganic	Low	High	Low	Low to moderate	Occasional

I.Classification of deposits in pulp and paper mills



1. Photomicrograph of deposit sample from a paper machine headbox prior to boilout shows typical barium sulfate crystal structure

required to remove stubborn scale.

Calcium oxalate is a hard, tan scale, and barium sulfate has a crystalline structure, as illustrated in **Fig. 1.** Both scales are very difficult to remove from smooth surfaces. Concentrated alkaline cleaning compounds in combination with dispersants and surfactants can loosen the deposits to be removed with mechanical cleaning action, e.g., hydroblasting.

In addition, sequestering agents can be added to cleaning solutions for scale removal in pulp and paper mills. Several chelants are available to handle complex soluble metal ions and to react with insoluble compounds or scale. The stoichiometric reaction varies with the specific metal ions, solution pH, and temperature.

Proper application and evaluation

An effective cleaning program should include the following elements:

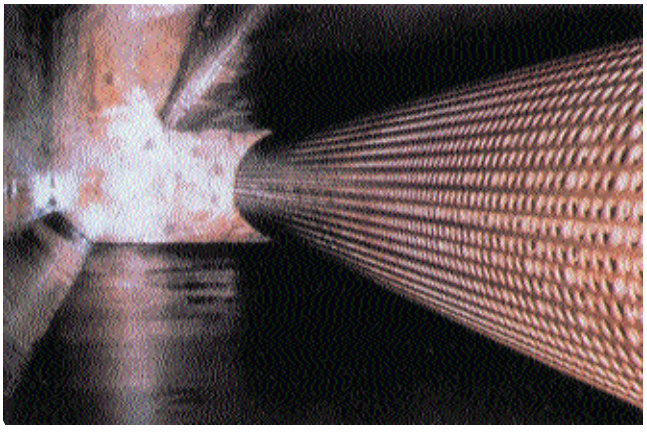
1. Pre-boilout inspection. Conduct a general inspection of the entire system. Areas requiring special attention should be noted, and areas of corrosion can be earmarked for monitoring or repair. Discuss safety procedures and emergency responses with the maintenance crew.
2. High pressure rinse. To remove loose surface deposits, hose off all accessible surfaces with high pressure hoses using fresh water. Be sure to rinse areas in the forming and pressing sections that will not come in contact with the boilout solution.
3. Boilout. A hot (150°-180°F) cleaning solution should be recirculated through the system for a minimum of 2 h. Longer times are necessary if the system is unusually dirty.

Figures 2-5 are photos of a headbox rectifier roll and a stock transfer line before and after boilout.

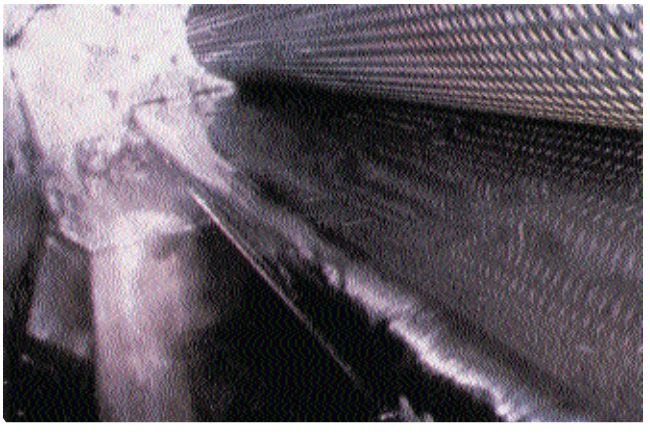
Types of cleaners

Acid cleaners. Usually employed in concentrations from 0.2% to 0.5%, although the concentration may be as high as 5%. Caution should be taken to prevent unnecessary attack to machine surfaces and fabrics.

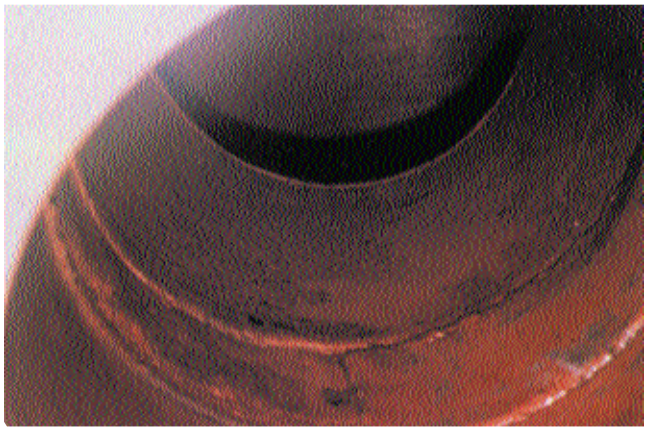
Alkaline cleaners. A satisfactory alkaline cleaning solution can be prepared in any convenient chest, pulper,



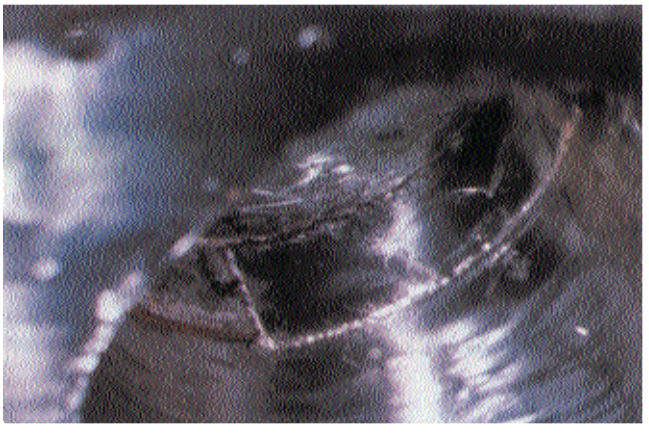
2. Headbox rectifier roll cover coated with scale



3. Headbox after an effective boilout



4. Stock transfer line before boilout



5. Stock transfer line after an effective boilout

or tank by adding approximately 50 lb of alkaline material and 50 lb of nonionic dispersant or surface-active agent to each 1000 gal of water.

Chelates. Used in association with an alkaline material, chelates are effective in removing barium sulfate scale. Solution strengths will be determined by stoichiometric demand, but they are typically on the order of 2%-10%.

Monitoring

Solution samples should be taken periodically to monitor variables such as pH, temperature, alkalinity, or chelant concentration. Following the boilout, inspections will reveal the effectiveness of the cleanup. Any areas still containing adherent deposits should be mechanically cleaned by scraping or brushing, or they should be more thoroughly washed with high-pressure hoses to ensure complete deposit removal.

Designated stagnant areas and stock chests should be flushed with a toxicant-dispersant. Toxicant solutions of a cationic nature (e.g., amines or quaternary amines) will adhere to walls and machine surfaces to inhibit the growth of microorganisms. A solution strength of 2 to 5% should be circulated through the system after the boilout mixture has been flushed and the system passes inspection.

Performance evaluation

Qualify the benefits your cleaning program brought to the mill, including runnability, product quality, biological control, and downtime. Quantify its value to determine the return-on-chemical-investment.

A well-planned program affords the opportunity to purge the entire system of all deposits and to reduce deposit formation once production has been resumed. It should improve performance in such areas as biological control, steam consumption, equipment performance, productivity, maintenance downtime, and product quality. TJ

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